

## Dual Structure Model for the Formation of the Japanese Population

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# Dual Structure Model for the Formation of the Japanese Population

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**ABSTRACT**

A 'dual structure model' for the population history of Japanese is an idea obtained through analysis of anthropological data which cover the ages from the Palaeolithic to modern times, and the areas of Japan, Asia and the Pacific.

Elemental populations involved in the formation of the Japanese population may have been Jomonese who supposed to have originated in Southeast Asia and the migrants after the Yayoi age whose homeland was probably in Northeast Asia. Admixture between both populations progressed until today, but it is not yet completed. Modern Japanese are, therefore, heterogeneous, showing different rate of admixture from area to area in the Japanese islands. Such difference seems to be responsible for the geographic variation which occurs in Japanese. Local difference in the Japanese culture may also be largely affected by different degrees of admixture between the two elements.

Since the middle 19th century several theories have been proposed in regard to the population history of Japanese. Franz Philipp von Siebold was the first scientist who carried out anthropological studies of Japanese. He came to Japan in 1823 as a physician of the Dutch settlement at Nagasaki, and collected a large number of specimens and information concerning the Japanese culture and natural history including anthropological data.

Soon after the Meiji Restoration in 1868, many European and American scholars were invited by new Japanese Government to help Japan's modernization. Among them, the scholars who provided important contribution to anthropology as well as archaeology of Japan were Edward E. Morse from Boston, Erwin von Baelz from Germany, and John Milne from England.

In the late 19th century, Japanese students who studied abroad returned home and succeeded the works initiated by visiting scholars. Anthropology, archaeology, folklore and related sciences have been pushed forward by Japanese investigators since then.

As regards the population history of Japanese, several important theories have been proposed during the last one and a half centuries on the basis of several evidence of osteology, somatology, genetics, dental anthropology and so forth. However, most of them were forced to be revised or abandoned as new findings were accumulated. On the other hand, important facts pointed out by earlier scholars were sometimes ignored by later investigators but they should be reevaluated in the light of recent evidence and methodology.

Representative theories so far proposed may be grouped into 1) replacement theory by Morse (1879), Milne (1882), Koganei (1893) and others; 2) dual physique theory by Baelz (1883, 1885); 3) hybridization theory by Kiyono (1949) and Kohama (1960); 4) continuity theory by Hasebe (1949) and Suzuki (1969); and 5) migration theory by Kanaseki (1976) and his successors.

The replacement theory emphasizes that the Neolithic Jomon population—Jomonese—was replaced by other populations who gave rise to modern Japanese. The dual physique theory stresses somatological heterogeneity in recent Japanese. The hybridization theory states that Jomonese who intermixed with the north Asians gave rise to the present-day Ainu, and those with south Asians to modern non-Ainu Japanese. The continuity theory attributes special im-

portance to gradual changes in morphology which took place during the course of microevolution, stressing a direct lineage from Jomonese to modern Japanese.

These theories cannot explain, however, all the available evidence related to the Japanese population. In particular, geographic variations in modern Japanese, or genetic as well as morphological clines in the Japanese Archipelago, close affinities among Ainu, Ryukyus (Okinawa islanders) and Jomonese, a large extent of northeast Asian influence to Japanese, and regional differences in various kinds of cultural elements are remained unexplained.

The migration theory which assumes a fairly large scale of migration from northeast Asia in the Aeneolithic Yayoi age seems to cover weakness in the previous theories. According to Kanaseki's original view (Kanaseki et al., 1960), however, the scale of migration was so small that the indigenous Japanese people were influenced little by the migrants. Nevertheless, a number of later findings unveiled the large impact of the migrants to Japanese as a whole.

During the last 25 years I collected dental and cranial data from the different local groups of Japanese and analyzed them using several methods of numerical taxonomy. The followings are the most basic and important results obtained so far.

(1) Suzuki (1982) pointed out that the Upper Palaeolithic Minatogawa man from Okinawa Island was morphologically much closer to Liujiang Man from south China than to Upper Cave Man in north China. Suzuki also emphasized close similarity between Minatogawa Man and Jomonese. A principal component analysis (PCA) of cranial measurements confirms Suzuki's view, suggesting further that Jomonese are close to the Upper Palaeolithic south Asians in cranial morphology (K. Hanihara, 1984).

(2) In the early Yayoi age, populations which were largely different from indigenous people, or the descendants of Jomonese, in skeletal morphology appeared abruptly in northern Kyushu. Kanaseki and colleagues (1960) emphasized that they were migrants probably from the northern part of Korean Peninsula. The number of sites which yielded migrant-type skeletal remains has been increased during the last 30 years, and morphological as well as cultural difference between the so-called migrants and indigenous populations became more evident. Statistical analyses of cranial data from the two groups of Yayoi populations and those from different populations in the Asian mainland show close affinities between the migrants and the northeast Asians in east Siberia, the northeastern part of China, and Mongolia. It is quite likely, therefore, that the original places of the Yayoi migrants can be attributed to northeast Asia (K. Hanihara, 1984).

(3) A PCA of cranial measurements from the Japanese populations of different ages and regions shows an evident difference between Jomonese and the succeeding populations. Namely, Jomonese form a single group with relatively small variability but the populations of the Yayoi, proto-historic Kofun and recent ages show much wider ranges of variability and a trend of bipolarization, one of which corresponds to the lineage of migrants and the other to that of Jomonese. At the same time, the former tends to be distributed in western Japan and the latter in eastern Japan. This trend may suggest that part of Japanese, particularly those in western Japan, have been influenced by the migrants in and after the Yayoi age. It is also noteworthy that the difference between the two groups is particularly evident between northern Kyushu and the other regions in the Yayoi age (3rd century B.C. - 3rd century A.D.), between western and eastern Japan in the protohistoric Kofun age (4th - 6th centuries A.D.), and between the Honshu-Kyushu-Shikoku and Hokkaido (Ainu) -Okinawa (Ryukyus) areas

in the recent age. Such a chronological change in regional difference likely suggests that the influence of the migrants extended gradually to eastern Japan with the times (K. Hanihara, 1987b).

(4) Geographic variations in recent Japanese provide another important basis in reconstructing the population history. For example, the distribution pattern of the ABO blood group genes, stature, cephalic indices, etc. show an evident cline from western to eastern Japan. Cephalic indices and cranial measurements in recent Japanese also show geographic variations and they tend to become closer to Ainu as we go northeastwards along Honshu. Stature is also higher in western Japan, particularly in the northern Kyushu, Chugoku and Kinki districts. Interestingly, all the characteristics in the western Japanese are closer to the northeast Asian populations, and those in the eastern Japanese to Jomonese and Ainu (K. Hanihara, 1985).

(5) Ainu, who were once considered as a branch of Caucasians, and Ryukyus resemble each other in not only morphology but also in the distribution pattern of genes. Statistical analyses of cranial measurements further show that Jomonese are much closer to these two populations than to recent Japanese in the main islands — Honshu, Kyushu and Shikoku. This fact seems to suggest that Ainu and Ryukyus are influenced little or nothing at all by the migrants from northeast Asia. Basically the same idea is also provided through studies on non-metric cranial traits (Ossenberg, 1986; Dodo & Ishida, 1988). Historically, Ainu and Ryukyus were almost independent of the Japan's Imperial Court or feudal government until recent times. Such a political, and probably geographical, isolation may have been responsible for retaining their own gene pool (K. Hanihara, 1984, 1990).

(6) Geographically isolated groups in Japan are more or less similar to Ainu, Ryukyus and Jomonese in dental morphology, but different from a majority of modern Japanese (T. Hanihara, 1989a, b). At the same time, a close similarity between Jomonese-Ainu-Ryukyus group and Philippine Negritos in dental characteristics is evidently recognized (T. Hanihara, 1989c; Hanihara & Hanihara, 1990). Taking these findings together with Omoto's (1984, 1986) genetic studies on Negritos into consideration, the Jomonese characteristics still retained in part of modern Japanese may have been derived originally from early southeast Asians.

(7) A computer simulation based on the annual rates of population increase and secular changes in cranial morphology shows that the total number of migrants from the Asian mainland is estimated to be from ca. 400,000 to more than 1,000,000 during the period of 1,000 years from the beginning of the Yayoi age to the 8th century (K. Hanihara, 1987a). Although the range of estimates is wide and the initial values used in simulation are not reliable enough, the estimates seem to be not far from the fact because morphological characteristics and gene combinations in modern Japanese show dominant northeast Asian elements. It is quite probable, therefore, that a fairly large number of people migrated to the Japanese Archipelago. Most of anthropologists and archaeologists used to believe that the number of migrants was very small or almost negligible. However, if we adopt various current evidence showing a large impact of migrants upon the indigenous Japanese people, this idea is hardly acceptable.

(8) Heterogeneity in the Japanese population was proved on the basis of dental morphology. Similarity between Ainu and Ryukyus, and difference between these two groups and the Japanese main islanders were first reported by Hanihara and colleagues using dental charac-

teristics (K. Hanihara et al., 1974). Turner and colleagues (Turner, 1976, 1979, 1986, 1987; Turner & Hanihara, 1977) as well as Brace and colleagues (Brace et al., 1982, 1989) conducted dental anthropological studies on Japanese and surrounding populations, recognizing apparent differences among the Ainu-Jomonese and modern main island groups. The former is represented by 'sundadont' and the latter by 'sinodont' dental patterns in Turner's terminology.

(9) There are non-human evidence which are almost parallel to human geographic variations in the Japanese Archipelago. According to Tanabe (1990), the northeastern Japanese dogs are similar to the south Asian dogs and the western Japanese dogs to the north Asian dogs in genetic polymorphisms. Moriwaki and colleagues (see Yonekawa *et al.*, 1988) found almost the same trends in the distribution pattern of Japanese mice, *Mus musculus molossinus*. In other words, dogs and mice similar to those in south Asia are distributed in the areas where the Jomonese characteristics are still retained, and *vice versa*. It is likely, therefore, that dogs and mice in northeastern Japan may have been introduced from south Asia in or earlier than the Jomon age, and those in western Japan from north Asia in or later than the Yayoi age.

Putting all of these findings together, the points to be considered in combination are (1) that the Jomon tradition is still retained at least in part of Japan's local areas; (2) that the geographic variation in physical characteristics do not show a random distribution but clines running through the Japanese Archipelago from northeast to southwest; (3) that close affinities between northeast Asians and Japanese have become evident after the Yayoi age; (4) that Jomonese, present-day Ainu and Ryukyus closely resemble each other but they differ largely from a majority of modern Japanese in the main islands; and (5) that several cultural elements are different to each other between eastern and western Japan.

In sum, the Japanese population consists of at least two elements, one of which came from southeast Asia and the other from northeast Asia. The same is also true in cultural evidence. Another point of importance is that the difference between the two elements has become evident since the Yayoi age and is still retained in the modern Japanese. On the basis of these evidence, a 'dual structure model' for the population history of Japanese may be employed as a working hypothesis which explains several findings mentioned above. I would like to emphasize that this model can be applied not only to physical traits but also to several cultural evidence in Japan.

Figure 1 is a schematic figure drawn on the basis of the 1st and 2nd principal components which were computed from 9 representative cranial measurements. Viewed at the angle of 'dual structure model', this figure may be interpreted as follows: The Palaeolithic southeast Asians probably gave rise to Jomonese on one hand, and to the Neolithic northeast Asians on the other. The former changed to the present-day Ainu and Ryukyus in the course of microevolution, and the latter to the modern northeast Asians who adapted to the extremely cold climate. In and after the Yayoi age, migrants who settled in the Japanese Archipelago admixed with indigenous people who were the descendants of Jomonese. As a result of admixture which took place in different magnitude in different regions, the Japanese main islanders as a whole took a different course of secular changes from that of the Ainu-Ryukyus group.

The details of the 'dual structure model' will appear in the Japan Review. (K. Hanihara,



1991; published in April, 1991).

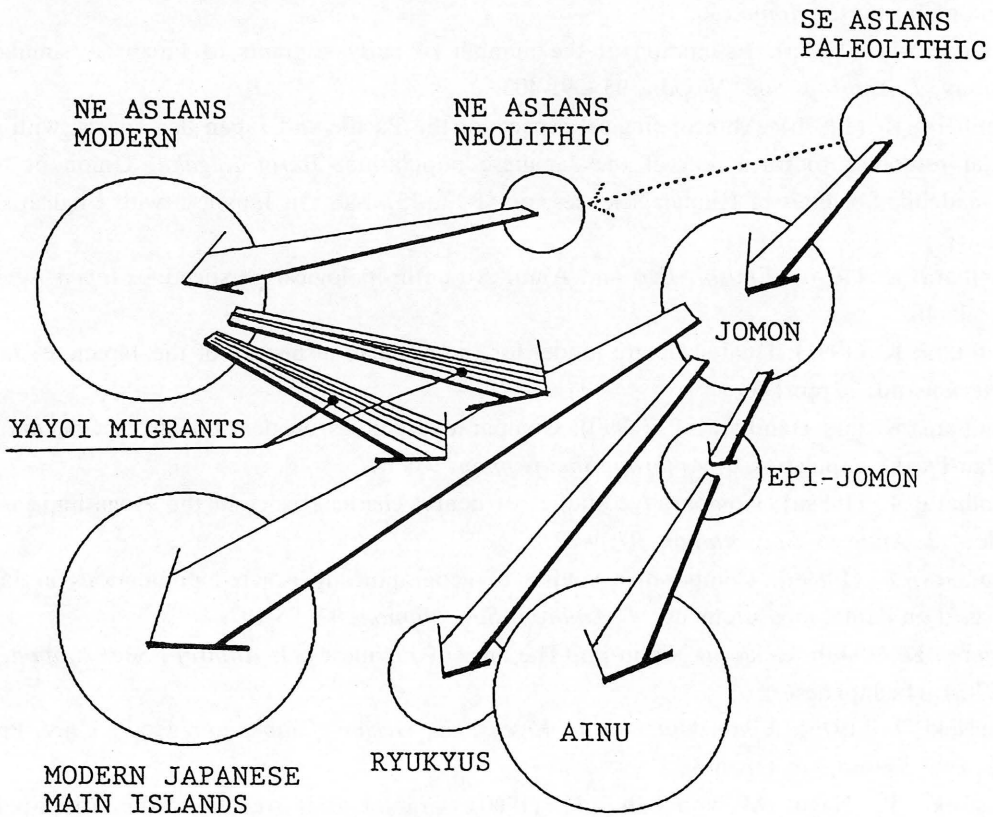


Fig 1. Schematic figure representing the microevolutionary course of Japanese. This figure was drawn on the basis of the 1st and 2nd principal components computed from 9 cranial measurements.

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日本人集団の形成—二重構造モデル  
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ここに提唱した日本人集団の二重構造モデルは、旧石器時代から現代まで、また日本を中心とするアジア、太平洋地域に分布する各集団の人類学的データを数量分類学的に分析した結果得られた一つの考え方である。

日本人を形成する原集団は、おそらく東南アジアに起源をもつ縄文系と、弥生時代以降に渡来した東北アジア系の集団であろう。これら2集団は互いに混血しつつ今日に至ったが、その混血は現在も完了しておらず、地域によって混血率を異にする。これが日本人の地域差を生じたが、日本文化の地域差もその影響を受けていると思われる。